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(54) **Production of hydrogen and carbon monoxide containing synthesis gas by partial oxidation**

(57) A process for the preparation of a synthesis gas containing hydrogen and carbon monoxide by a combination of catalytic partial oxidation and further an autothermal reforming process, comprising

- (a) providing separate streams of predetermined proportions of a hydrocarbon feedstock, an oxygen source and of process steam,
- (b) injecting said separate streams into a catalytic partial oxidation reaction zone to react, and to form a prereformed product stream,
- (c) introducing the prereformed product and a predetermined proportion of a second oxygen source into a further partial oxidation process step forming a further partially oxidised process stream by flame

reactions,

(d) reacting the further partially oxidised process stream in the reaction zone constituting a steam reforming process step to form a synthesis gas product stream, and

(e) withdrawing the synthesis gas product stream from the further partial oxidation process step and the steam reforming process step, the two steps constituting the autothermal reforming process.

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EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 2 311 790 A (BRITISH GAS PLC) 8 October 1997 (1997-10-08) * page 17, last paragraph - page 18, line 11 * * page 24, line 15 - page 25, line 20; figure *	1,4	C01B3/38
A	--- EP 0 329 292 A (ICI PLC) 23 August 1989 (1989-08-23) * page 7, line 50 - line 57; figure *	1	
A	--- WO 98 49095 A (EXXON RESEARCH ENGINEERING CO) 5 November 1998 (1998-11-05) * page 9, line 1 - line 11 * * page 16, last paragraph - page 17, line 25; figure 1 * * claims 1,11 *	1	
A	--- US 5 980 596 A (GONATAS CONSTANTINE P ET AL) 9 November 1999 (1999-11-09) * column 9, line 18 - line 67 * * figure 1 * * claim 1 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	--- US 5 023 276 A (YARRINGTON ROBERT M ET AL) 11 June 1991 (1991-06-11) * column 12, line 52 - column 12, line 67; figure 1 * * claim 1 *	1	C01B
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 29 April 2003	Examiner Harf-Bapin, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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29-04-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2311790	A	08-10-1997	AU 713494 B2	02-12-1999
			AU 2299197 A	29-10-1997
			CA 2250893 A1	16-10-1997
			EP 0891295 A1	20-01-1999
			WO 9737930 A1	16-10-1997
			JP 2000508286 T	04-07-2000
			RU 2161120 C2	27-12-2000
			ZA 9702890 A	16-04-1998
EP 0329292	A	23-08-1989	AU 2980689 A	24-08-1989
			CN 1045092 A ,B	05-09-1990
			DK 68389 A	19-08-1989
			EP 0329292 A2	23-08-1989
			JP 2003614 A	09-01-1990
			NO 890676 A	21-08-1989
			NZ 227799 A	26-07-1991
			US 4910228 A	20-03-1990
			ZA 8900794 A	27-12-1989
WO 9849095	A	05-11-1998	US 6267912 B1	31-07-2001
			AU 7143498 A	24-11-1998
			EP 1017620 A1	12-07-2000
			JP 2002512557 T	23-04-2002
			NO 995210 A	15-12-1999
			WO 9849095 A1	05-11-1998
			ZA 9803117 A	22-10-1998
US 5980596	A	09-11-1999	AU 7146398 A	24-11-1998
			AU 7251498 A	24-11-1998
			EP 0977706 A1	09-02-2000
			JP 2002508733 T	19-03-2002
			NO 995203 A	14-12-1999
			TW 422814 B	21-02-2001
			WO 9849093 A1	05-11-1998
			WO 9849096 A1	05-11-1998
US 5023276	A	11-06-1991	AT 61316 T	15-03-1991
			AU 572797 B2	19-05-1988
			AU 1972883 A	05-04-1984
			CA 1217504 A1	03-02-1987
			DE 3382193 D1	11-04-1991
			DK 448383 A ,B,	31-03-1984
			EP 0112613 A2	04-07-1984
			ES 8503717 A1	16-06-1985
			IN 161251 A1	31-10-1987
			JP 59097501 A	05-06-1984

EPO FORM 1 P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

EP 1 188 713 A3

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 12 0961

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29-04-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5023276	A	KR NO	05-11-1991
		9109208 B1 833522 A ,B,	02-04-1984

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82